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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/604,565	07/30/2003	Kangguo Cheng	FIS920030163US1	1564
29371	7590	06/15/2004	EXAMINER	
CANTOR COLBURN LLP 55 GRIFFIN ROAD SOUTH BLOOMFIELD, CT 06002			LE, THAO P	
			ART UNIT	PAPER NUMBER
			2818	

DATE MAILED: 06/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Applicati n No.

10/604,565

Applicant(s)

CHENG ET AL.

Examiner

Thao P. Le

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 May 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 7/30/03 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 7/30/03.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date, _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Oath/Declaration

1. The oath/declaration filed on 7/30/03 is acceptable.

Election/Restriction

2. Examiner confirms that Applicants elected to prosecute Claims 1-20 without prejudice.

Information Disclosure Statement

3. Information Disclosure Statement (IDS) filed on **7/30/03** and made of record.
The references cited on the PTOL 1449 form have been considered.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-4, 6-7, 10, 11-14, 16-17, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kudelka et al., U.S. Patent No. 6,426,254.

Regarding to claims 1 and 11, Kudelka et al. discloses a method for forming a memory storage cell in a semiconductor substrate or for a dynamic random access memory (DRAM) device (lines 6-15, Col. 4), the method comprising (See Figs. 2-17, Cols. 1-10):

- . forming a deep trench in a semiconductor substrate (Fig. 2),
 - . forming a dopant source material (ASG, 111; Fig. 2) over a lower portion of the deep trench,
 - . shaping an upper portion of the deep trench (prepare for forming collars; lines 53-67, Col. 4),
 - . annealing the dopant source material so as to form a buried plate 112 (Fig. 3) of a trench capacitor (lines 35-52, Col. 4);
- wherein the buried plate is self aligned to the upper portion of the deep trench (lines 4-15, Col. 5; Fig. 5).

Kudelka et al. fails to disclose wherein the upper portion of the deep trench is shaped to a rectangular configuration. However, Kudelka et al. discloses the lower portion of the deep trench is shaped to a rectangular configuration (lines 28-35, Col. 6), and Kudelka et al. also discloses that this invention may be applicable to widening any trenches formed in substrate (lines 57-60, Col. 7). It would have been obvious to one having ordinary skill in the art at the time the invention was made to widen the upper

portion of the deep trench in a rectangular configuration because Kudelka et al. discloses that this invention is not limited to several illustrative embodiments described in the invention but also would be applicable to widening any trenches formed in substrates depending on one's desired structure of device and because the rectangular configuration would yield higher capacitance and increase surface areas (lines 1-5, Col. 4; lines 3-6, Col. 8).

Regarding to claims 2 and 12, Kudelka et al. discloses the shaping step/etching step of the trench is implemented through a basic solution such as KOH or NH₄OH (lines 65-67, Col. 5; lines 1-3, Col. 6) but fails to disclose the solution is ammonia. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use ammonia or KOH or NH₄OH because these solutions are basic solutions and they are equivalent in functions and properties (pHs are about equal) for their use in the etching process and the selection of any of these known equivalent chemicals would be held within the level of ordinary skill in the art.

Still regarding to claims 2 and 12, Kudelka et al. further discloses wherein the etch having an etch rate selective to a crystal orientation of the substrate material (lines 13-25, Col. 6).

Regarding to claims 3 and 13, Kudelka et al. discloses wherein the dopant source material comprises arsenic doped oxide (ASG) (lines 5-10, Col. 5).

Regarding to claims 4 and 14, Kudelka et al. discloses the step of forming a cap layer 107 (Fig. 5) over the ASG layer 105 (Fig. 5) following the shaping an upper portion of deep trench (prepare for forming collar on upper trench; Cols. 4-5).

Regarding to claims 6 and 16, Kudelka et al. discloses wherein the forming a dopant source material over a lower portion of the deep trench comprises: depositing the dopant source material 111 (Fig. 2) over the trench sidewall and lower surfaces (see Fig. 2), filling the deep trench with a photoresist material 103, etching a portion of the dopant source material on an upper part of the deep trench wherein the recessed photoresist serves as an etch stop layer (lines 40-47, Col. 4).

Regarding to claims 7 and 17, Kudelka et al. discloses the steps of removing the remaining photoresist material from the lower portion of the deep trench and performing a thermal annealing so as to cause the dopant source to diffuse into the substrate, and removing the dopant source material and a cap layer formed over the dopant source material (lines 35-65, Col. 4; lines 1-15, Col. 5).

Regarding to claims 10 and 20, Kudelka et al. discloses the step of etching dopant source material and cap layer and preparing the surface of lower portion of deep trench using dilute HF but Kudelka fails to disclose the use of HF to remove dopant source material and cap layer. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use dilute HF to remove dopant source material and cap layer because dilute HF is well known to be used to remove ASG and nitride material and Kudelka et al. discloses that the dopant source material is made of ASG and the cap layer is nitride (Col. 5).

6. Claims 5, 8-9, 15, 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kudelka et al., U.S. Patent No. 6,426,254 and in view of S. Wolf and R.N. Tauber, Silicon Processing for the VLSI Era, Vol. 1, Lattice Press, California, pp. 307-308, 323-324.

Regarding to claims 5, 8, 15, and 18, Kudelka et al. discloses the limitations as applied for claims 1, 6-7, 11, 16-17 above including the step of annealing the dopant source material to form a buried plate in the lower portion of the deep trench. However, Kudelka et al. fails to disclose wherein the annealing is implemented at about 1050 oC for about 3 minutes. S. Wolf and R.N. Tauber disclose the annealing process that requires the temperature of at least 1000 oC and within about 30 minutes (307-308). It would have been obvious to one having ordinary skill in the art at the time the invention was made to perform an annealing process at the temperature of 1050 oC for about 3 minutes because at that temperature and time, impurities can be implanted effectively. In addition, it would have been obvious to one having ordinary skill in the art at the time the invention was made to that he selection of these parameters such as **energy, concentration, temperature, time, molar fraction, depth, thickness, etc.**, would have been obvious and involve routine optimization which has been held to be within the level of ordinary skill in the art. "Normally, it is to be expected that a change in **energy, concentration, temperature, time, molar fraction, depth, thickness, etc., or in combination of the parameters** would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in

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kind and not merely degree from the results of the prior art ... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

In re Aller 105 USPQ233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Regarding to claims 9 and 19, S. Wolf and R.N. Tauber disclose the annealing process is performed in an oxygen-containing atmosphere (pages 308, 324).

7. If Applicants are aware of better art than that which has been cited, they are required to call such to attention of the examiner.

8. When responding to the office action, Applicants' are advice to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner to locate the appropriate paragraphs.

A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao P. Le whose telephone number is 571-272-1785. The examiner can normally be reached on M-T (7-6).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on 571-272-1787. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Thao P. Le
Examiner
Art Unit 2818